



# Mapping County-Level Religious Diversity: A Comprehensive Bayesian Approach to the 2023 Census of American Religion

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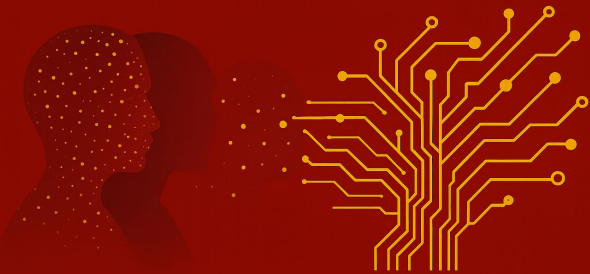
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# Study Background

- Researchers studying trends in religious affiliation across the US are forced to rely on surveys by non-governmental organizations.
  - Religious affiliation is not measured on the US Census or via American Community Survey, for example.
- To address gaps in governmental data sources, *Public Religion Research Institute (PRRI)* and Ipsos partnered to create county-level estimates of 19 religious affiliation groups\* for all US counties.
  - These estimates are important for providing a comprehensive picture of religious diversity across the entire US, and understanding changes in population demographics over time.

\* As described below, some of these categories consisted of religious-ethnic affiliations.

# Background

- **Obtaining estimates of religious affiliation at reasonable levels of geographic aggregation is challenging using traditional survey methodologies and commercial probability panels.**
  - **This is due to the sparse distribution of sample across small but meaningful geographic aggregations (for example, all 3,144 counties in the US).**
- **Ipsos's solution for PRRI was to apply *small area estimation (SAE)* models, using a cumulative three-year Ipsos KnowledgePanel sample of 62,284 survey respondents.**
  - **Ipsos KnowledgePanel is the original and most well-established probability-based online research panel in the U.S, consisting of over 60,000 active panelists and featuring over 2,000 profile variables.**
  - **The SAE model was specially developed to estimate the proportion of the population falling into each of the 19 religious / demographic groups simultaneously, drawing upon information from the prior PRRI census.**

# Method

# Method

## Data and Measures

- **The Ipsos KnowledgePanel sample consisted of a total of 62,284 respondents (pooled across quarterly samples, collected 2021-2023).**
  - **The main outcome of interest was respondents' membership in one of 19 religious / demographic categories (see next slide).**
- **Auxiliary data were collected from the Census' American Community Survey (ACS) to boost model performance, and consisted of county-level estimates<sup>1</sup> of the following:**
  - **Gender**
  - **Age (18-29, 30-44, 45-59, 60+).**
  - **Income (< 50k, 50-100k, >100k).**
  - **Race (White, Black, Hispanic, Other).**
  - **Education (College Degree, no College Degree).**
  - **Metro status.**
  - **Trump Vote, 2020 Presidential Election.**
  - **PRRI 2020 county-level estimates.**

<sup>1</sup>Note: ACS does not release county-level information, so Ipsos used an in-house procedure for imputing

# Method

## Data and Measures – Self-Reported Religious / Demographic Categories Used in SAE Model

| RELIGION CATEGORY                              |
|------------------------------------------------|
| White, Non-Hispanic evangelical Protestant     |
| White, Non-Hispanic mainline Protestant        |
| Black, Non-Hispanic Protestant                 |
| Hispanic, Protestant                           |
| Other, Non-Hispanic Protestant                 |
| White, Non-Hispanic, Catholic                  |
| Hispanic, Catholic                             |
| Other, including Black, Non-Hispanic, Catholic |
| Jehovah's Witness                              |
| Mormon                                         |

| RELIGION CATEGORY      |
|------------------------|
| Orthodox Christian     |
| Not Included           |
| Jewish                 |
| Muslim                 |
| Hindu                  |
| Buddhist               |
| Unitarian Universalist |
| Other religion         |
| Unaffiliated           |

# Method

## SAE Model (Essential Details)

- **We used a Dirichlet model (Ghosh et al, 1998; Sennhenn-Reulen, 2018), with a weakly informative prior .**
  - Model featured *random effects* for state, region, and county; *fixed effects* for all other predictors.
  - Only counties with at least 20 responses from Ipsos KnowledgePanel were used to fit the model (sample of 50,642); for the 10 largest counties in the US we used direct estimates (next slide).
  - Sampling design was incorporated into the model via the use of survey weights to generate the predicted Y (religious affiliation multinomial).
  - We further included the square root of the Ipsos KnowledgePanel sample size in the model to adjust for uncertainty based on size of estimates
  - Model diagnostics indicated proper convergence (R-hat approximately 1, no divergent transitions, etc.).

# Method

## The 10 Most Populous Counties in Pooled Sample (Direct Estimation Used)

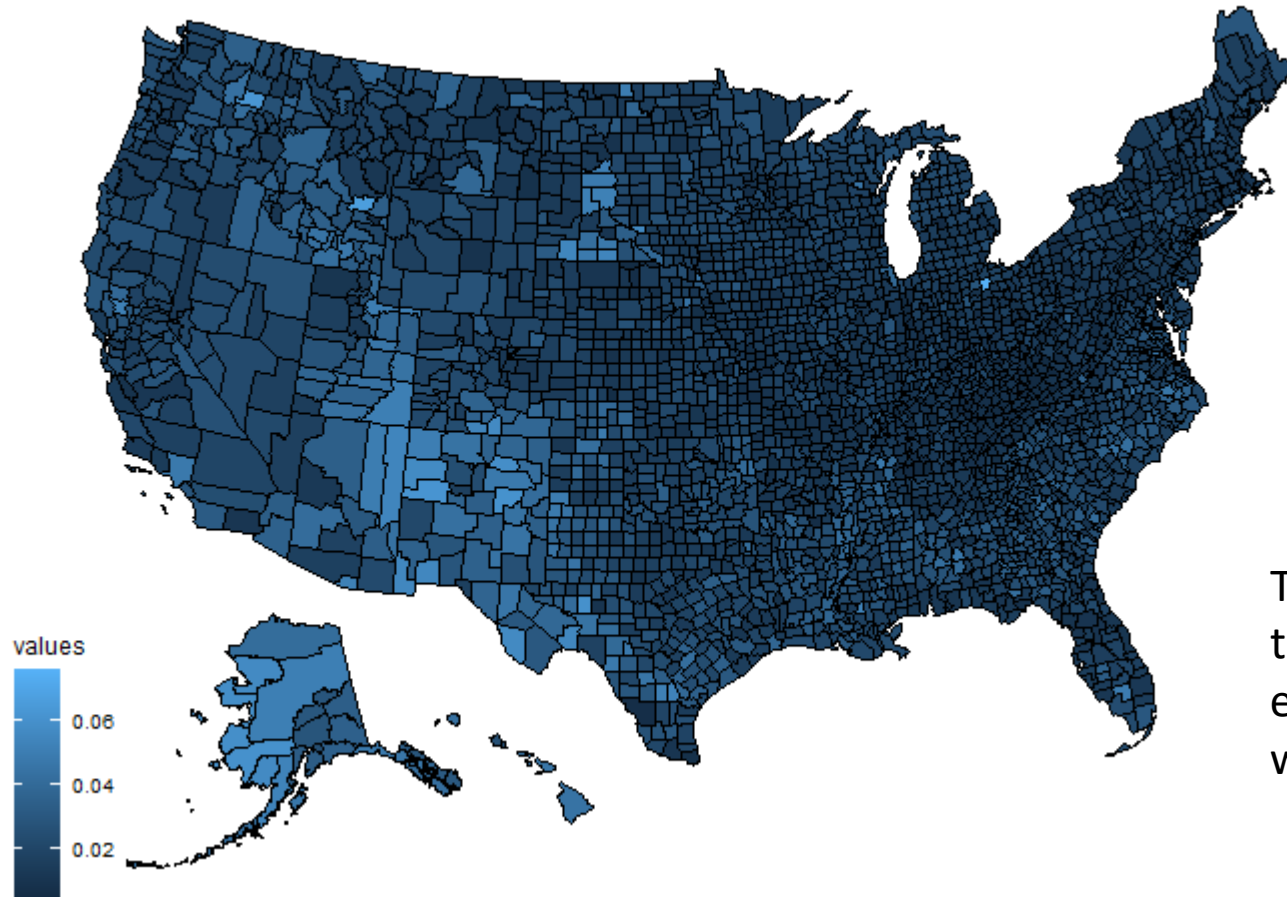
- Los Angeles, CA
- Maricopa, AZ
- Cook, IL
- Harris, TX
- San Diego, CA
- Miami-Dade, FL
- Orange, CA
- Riverside, CA
- King, WA
- Clark, NV

# Results

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## Average Absolute Difference (AAD) Across 19 Religions Between 2020 and 2024 Estimates

Average Absolute Difference Between 2024 and 2020 Estimates



|                   | <b>Full<br/>19<br/>Categories</b> | <b>Collapsed<br/>14<br/>Categories</b> |
|-------------------|-----------------------------------|----------------------------------------|
| <b>Min AAD</b>    | 0.0047                            | 0.0040                                 |
| <b>Q1 AAD</b>     | 0.0130                            | 0.0130                                 |
| <b>Median AAD</b> | 0.0172                            | 0.0172                                 |
| <b>Mean AAD</b>   | 0.0192                            | 0.0192                                 |
| <b>Q3 AAD</b>     | 0.0233                            | 0.0232                                 |
| <b>Max AAD</b>    | 0.0754                            | 0.0837                                 |

There is no real overarching geographic pattern to the the 2020-2024 changes, other than the fact that estimates for smaller counties were more volatile (as would be expected).

# National Estimates (Survey vs. SAE Estimates)

| RELIGION CATEGORY                              | Survey Est | SAE Est | Diff: SAE – Survey Est |
|------------------------------------------------|------------|---------|------------------------|
| White, Non-Hispanic evangelical Protestant     | 0.1434     | 0.1481  | 0.0047                 |
| White, Non-Hispanic mainline Protestant        | 0.1322     | 0.1522  | 0.0200                 |
| Black, Non-Hispanic Protestant                 | 0.0764     | 0.0726  | -0.0038                |
| Hispanic Protestant                            | 0.0372     | 0.0338  | -0.0034                |
| Other, Non-Hispanic Protestant                 | 0.0254     | 0.0216  | -0.0038                |
| White, Non-Hispanic, Catholic                  | 0.1290     | 0.1235  | -0.0055                |
| Hispanic, Catholic                             | 0.0847     | 0.0622  | -0.0225                |
| Other, including Black, Non-Hispanic, Catholic | 0.0184     | 0.0216  | 0.0032                 |
| Jehovah's Witness                              | 0.0145     | 0.0125  | -0.0020                |
| Mormon                                         | 0.0162     | 0.0181  | 0.0019                 |
| Orthodox Christian                             | 0.0036     | 0.0087  | 0.0051                 |
| Jewish                                         | 0.0203     | 0.0257  | 0.0054                 |
| Muslim                                         | 0.0061     | 0.0102  | 0.0041                 |
| Hindu                                          | 0.0069     | 0.0098  | 0.0029                 |
| Buddhist                                       | 0.0076     | 0.0113  | 0.0037                 |
| Unitarian Universalist                         | 0.0044     | 0.0109  | 0.0065                 |
| Other religion                                 | 0.0159     | 0.0200  | 0.0041                 |
| Unaffiliated                                   | 0.2579     | 0.2329  | -0.0250                |

# Discussion

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## Take-Aways and Caveats

- **Religious affiliation remained generally stable at the county level between the 2020 and 2023 PRRI census.**
- **SAE models help close the gap in government data sources by allowing pooling of information within and across various counties.**
- **Ipsos's KnowledgePanel's over 60,000 panelists combined with customized SAE modelling can enable reliable estimates of counties and other sub-state geographies**

# Discussion

## Additional Considerations, and Further Research

- **Synthetic Data may help to boost sample sizes in similar situations.**
  - **Many additional considerations would need to be addressed, however; best approach may involve integration of synthetic data into traditional small area estimation models.**

# References

**Ghosh, M., Natarajan, K., Stroud, T. W. F., & Carlin, B. P. (1998). Generalized linear models for small-area estimation. *Journal of the American Statistical Association*, 93(441), 273-282.**

**Sennhenn-Reulen, H. (2018). Bayesian regression for a Dirichlet distributed response using stan. *arXiv preprint arXiv:1808.06399*.**

**Thank you!**

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